b. Inorganic Mulches

Inorganic mulches include polyethylene films (black, silver, white, transparent), biodegradable plastics, and reflective mulches. Among these, black polyethylene mulch is the most widely used in commercial strawberry production. It effectively suppresses weed growth, conserves soil moisture, and enhances soil temperature, promoting early flowering and fruiting. Reflective silver mulches are also gaining popularity due to their ability to deter aphids and thrips by reflecting ultraviolet and visible light. Recently, biodegradable plastic mulches made from starch, polylactic acid (PLA), and cellulose have emerged as eco-friendly alternatives to conventional plastics, reducing long-term environmental pollution.

Influence of Mulching on Soil Microclimate

Mulching significantly alters the soil thermal and hydrological regime. Plastic mulches, especially black polyethylene, increase soil temperature by 2–5°C, which accelerates root activity and enhances nutrient uptake during the vegetative phase. In contrast, organic mulches tend to keep the soil cooler during hot weather and warmer during cold nights. Mulches reduce diurnal temperature fluctuations and maintain steady soil moisture levels by minimizing evaporation losses. Improved soil moisture availability ensures continuous plant growth and enhances fruit firmness and size. In addition, mulching reduces the impact of raindrop splashes and prevents soil compaction, maintaining favourable aeration around roots.

Weed Suppression and Disease Control

Weed competition is a major concern in strawberry fields, as weeds compete for light, nutrients, and moisture, and can also serve as alternate hosts for pathogens and insect pests. Black polyethylene mulch is especially effective in blocking sunlight, thus inhibiting weed germination and growth.

INTRODUCTION

Strawberry is a temperate fruit crop grown successfully in subtropical and even tropical regions under protected and open-field conditions. The shallow root system of strawberry requires consistent soil moisture and temperature for optimal root growth and fruit development. In fluctuating environments, mulching provides a protective layer over the soil, acting as a barrier against evaporative losses, weed emergence, and temperature extremes. Historically, straw mulch has been used since the early 19th century in Europe and North America to protect the fruits from direct contact with the soil—hence the name straw-berry. With the intensification of horticultural production, particularly under plasticulture systems, the role of mulching has evolved from a traditional practice to a modern precision management tool. Mulches now form an integral part of strawberry cultivation systems across major producing countries like the USA, Japan, China, and India, particularly in regions such as Himachal Pradesh, Maharashtra, and Karnataka. Types of Mulching Materials in Strawberry Cultivation Mulching materials are broadly classified into organic and inorganic categories, each with distinct advantages and limitations.

a. Organic Mulches

Organic mulches, derived from natural sources such as straw, dry leaves, sugarcane trash, sawdust, compost, coir pith, and grass clippings, decompose over time to enrich the soil with organic matter and enhance its physical, chemical, and biological properties by improving soil structure and porosity, enhancing microbial activity and nutrient cycling, reducing soil erosion and crust formation, and moderating soil temperature through surface insulation; however, these benefits are countered by limitations including rapid decomposition, the potential to harbour pests or pathogens, and generally lower weed suppression efficiency compared to plastic mulches.

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कोटा, राजस्थान

Importance of mulching technology in strawberry farming

संकलन

Dr. Awadhesh Kumar[1], Dr. Anil Kumar[2] and Dr. Saurabh Kanauajia[3]

[1]Subject Matter Specialist (Horticulture), Krishi Vigyan Kendra, Ballia, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh

[2]Assistant Professor, Department of Vegetables Science, College of Horticulture and Forestry, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh

[3]District Coordinator, Human Service Institute, Lucknow, Uttar Pradesh

Organic mulches also suppress weeds but are less effective over long durations, as decomposition creates gaps that allow weed establishment. Mulching also contributes to disease management, particularly in reducing Botrytis gray mold and Rhizoctonia root rot, by preventing soil-to-fruit contact and reducing humidity fluctuations. Reflective mulches have been reported to repel aphids, reducing the incidence of viral diseases such as strawberry mottle and crinkle virus.

Effect of Mulching on Growth and Yield Attributes

Numerous studies have reported positive effects of mulching on plant vigour, yield, and fruit quality. Black polyethylene mulch increases early flowering and fruit maturation, leading to higher marketable yield. Enhanced root-zone temperature promotes faster nutrient assimilation, while improved water conservation ensures sustained growth even under moisture-deficit conditions. Organic mulches improve the long-term soil fertility, resulting in better vegetative growth and subsequent fruit development. The use of rice straw or sugarcane trash mulch improves fruit size, firmness, and sugar-acid ratio, making the berries more attractive for fresh markets.

Influence on Fruit Quality Parameters

Mulching has a pronounced influence on several quality traits of strawberries, such as colon, firmness, soluble solids content (SSC), titratable acidity, and vitamin C concentration. Plastic mulches enhance fruit coloration by improving the microclimate and light interception. Black plastic mulch, by increasing soil warmth, also accelerates ripening, improving anthocyanin accumulation and sweetness. Organic mulches, on the other hand, promote a balanced nutrient supply, leading to improved flavour and aroma. However, they may result in delayed maturity compared to plastic mulches due to lower soil temperature.

Furthermore, mulching maintains uniform soil moisture around the root zone, ensuring efficient uptake of applied fertilizers. Mulches also reduce nitrogen volatilization and denitrification losses, particularly in warmer climates. Integrated use of fertigation under mulch has been shown to enhance yield and fruit quality while lowering fertilizer inputs.

Pest and Disease Management Aspects

Mulching modifies the microhabitat and can influence the population dynamics of pests and beneficial organisms. Reflective and silver-coloured mulches repel aphids and thrips, while transparent mulches may increase soil temperature to levels detrimental to soil-borne pests. Conversely, excessive humidity under mulch can sometimes favour the development of fungal pathogens like Botrytis cinerea. Therefore, ventilation management and judicious irrigation are essential in mulched fields. Biodegradable and organic mulches can harbour beneficial microbes such as Trichoderma and Pseudomonas, contributing to biological suppression of soil-borne diseases.

Economic and Environmental Considerations of using mulching

The adoption of mulching enhances profitability through higher yields, improved fruit quality, and reduced labour for weeding and irrigation. However, the cost and disposal of plastic mulches remain major concerns. Organic mulches, though cost-effective and environmentally friendly, require frequent replenishment and labour. The development of biodegradable and recyclable mulch films offers a sustainable alternative to conventional polyethylene-based materials. From an environmental standpoint, mulching contributes to soil conservation, reduction in greenhouse gas emissions, and better carbon sequestration through organic matter addition.

Challenges and Future Prospects

Despite its numerous benefits, mulching in strawberry cultivation faces several challenges, including the disposal and recycling issues associated with plastic mulches, labour and availability constraints for organic materials, increased initial setup costs for small-scale farmers, and the potential for altered soil microbial balance under prolonged use; therefore, future research should focus on developing biodegradable and photodegradable films, optimising mulch combinations with precision irrigation and fertigation, and evaluating the long-term ecological effects of different mulch types, while the integration of remote sensing and soil sensors could help monitor mulch performance and guide site-specific management decisions.

CONCLUSION

Mulching represents a cornerstone practice in sustainable strawberry cultivation, offering multifaceted benefits that extend from soil conservation to fruit quality enhancement. The choice of mulch type depends on climatic conditions, soil characteristics, and economic feasibility. While plastic mulches ensure superior weed control and early yield, organic mulches enhance soil health and ecological sustainability. Adopting mulch systems within integrated crop management frameworks can significantly improve productivity, profitability, and environmental stewardship in strawberry farming